

of the sun, a sudden storm uprooted the tree and the ensuing rain washed a miniature landslide over our luckless congregation in the stone crevice. Just below the grave I found seven more shells, probably members of the same group.

Although such an occurrence must be very rare indeed, perhaps it can find a place among the list of natural controls of the molluscan population. At any rate it shows that the effect of storms and rains cannot be entirely excluded.

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### SNAILS HOARDED BY *BLARINA* AT ITHACA, NEW YORK

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It is well known that the short-tailed shrew, *Blarina brevicauda* (Say), hoards snail and insect food (Merriam 1886), (Shull 1907), (Hamilton 1930). Additional information is presented here concerning the interesting storage habit of *Blarina*. These data were gathered from a small, rock strewn, sycamore flood plain in Six Mile Creek near Cornell University, Ithaca, New York. The period of observation extended from September 15, 1940, to January 3, 1941. Shrews were found hoarding snail food in both the fall and winter. Previous observations made from June 15 to September 1, 1940, on the Edmund Niles Huyck Preserve, Rensselaerville, Albany County, New York, have shown that *Blarina* will also hoard food during the summer months even though a food supply is abundant.

One shrew storage chamber opened in September revealed living individuals of the following species of mollusks: one *Anguispira alternata* (Say), three *Stenotrema hirsutum* (Say), and two *Ventridens intertextus* (Binney). These snails were active and were in no way injured. Five days later the storage chamber was reopened; all of the snails but two *S. hirsutum* had been broken open and eaten. The two unaccounted for *S. hirsutum* were nowhere to be found; no additions had been made to the storage chamber in the five day interval.

On December 24 a flat rock, 6 x 8 inches, was overturned revealing a vacated shrew discard shell chamber. Fairly fresh shrew seats showed that it had not long been abandoned. Twenty-nine empty mollusk shells and two opened chrysalis cases were scattered about. The snail species were: *Triodopsis albolabris* (Say), three adult and ten young; *Mesodon thyroidus* (Say), six adult and three young; *Triodopsis tridentata* (Say), five adult; *Succinea ovalis* Say, one adult; and *Haplotrema concavum* (Say), one adult. All individuals but the *S. ovalis* and the *H. concavum* had been opened. The majority had had the spires cut away by *Blarina* in order that the soft bodies could be removed by the small mammal. The breaking open of large shells by the short-tailed shrew as well as small is contrary to Shull (1907) who states, "It seems from these observations that in the case of large shells, breaking is a last resort." Dr. William J. Hamilton, Jr., of Cornell University in studying *Blarina* about New York State, has observed, as has the writer, that when large shells are found in shrew runs they are usually broken. Two of the species of mollusks that Shull (1907) studied in Michigan abound in shrew runs in Ithaca; these are *T. albolabris* (Say) and *M. thyroidus* (Say).

On January 16 while conducting an invertebrate zoology field trip two winter storage piles of *Blarina* were observed. One of these contained twenty-seven individuals representing five species, and the second fifteen individuals representing two species. In the first storage chamber all mollusks were stacked in a cavity in a sycamore stump. They were resting on the ground; snow had filtered into the cavity and was banked around the bottom layer of shells. The shells were frozen together and formed a roundly triangular-shaped mound. When these mollusks were carried into the laboratory all were prodded with a glass rod but none showed signs of life. All were gradually thawed out over forty-eight hours, but none recovered from the freezing to which they had been subjected in the shrew storage chamber. The fact that the snails were apparently frozen solid would have prevented these mollusks from crawling away. Twelve individuals had complete epiphragms, three had incomplete ones, and twelve had no epiphragms. Five *M. thyroidus* without epiphragms showed that epiphragms had at one time been pres-

ent, for fragments were found adhering to the apertures of the shells. These epiphragm fragments possibly indicate that the epiphragms had been broken by the shrews in their collecting efforts; too, the indication may be that in transporting the large shells *Blarina* often carries them by gripping the outer lip. The entrance into the shrew run was just behind the pile of mollusks. Several shell fragments and seats in the region of the pile indicated that mollusks in the storage pile were being fed upon above the ground. The mollusk species were: *M. thyroidus* (Say), fourteen mature and nine immature, and one adult of each of the following species, *Ventridens intertextus* (Binney), *Anguispira alternata* (Say), *Mesomphix cupreus* (Rafinesque), and *Triodopsis notata* (Deshayes).

The second winter storage chamber was three feet from the first, situated between two small sycamore stumps. Snails of this group were not piled but were scattered over the ground. When they were subjected to the prodding test none showed signs of life, nor did any become active during the gradual forty-eight hour thawing period. The snail species in the pile were eight adults and six young of *M. thyroidus* (Say) and one adult of *A. alternata* (Say).

No empty shells were found in either of the above storage piles, indicating that shrews probably distinguish empty shells from occupied ones by smell or weight and generally do not bother to carry empty shells to their storage piles. None of the mollusks in the storage piles had cracked shells indicating that for the *Blarina* studied, freezing rather than injury is "relied upon" to prevent the food supply from wandering off.

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